Ploughshares

FACT SHEET

Golden Dome Explained: Ambition, Reality, Risk

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In January 2025, US President Donald Trump signed Executive Order 14186, directing the development of a sweeping new missile defence system called Golden Dome. While still in the early stages, the plan envisions a vast, multi-layered shield extending from Earth into space, capable of intercepting everything from drones to nuclear missiles.

This fact sheet breaks down what Golden Dome is, how it would work, and why it raises serious questions about global security, space governance, and nuclear stability.

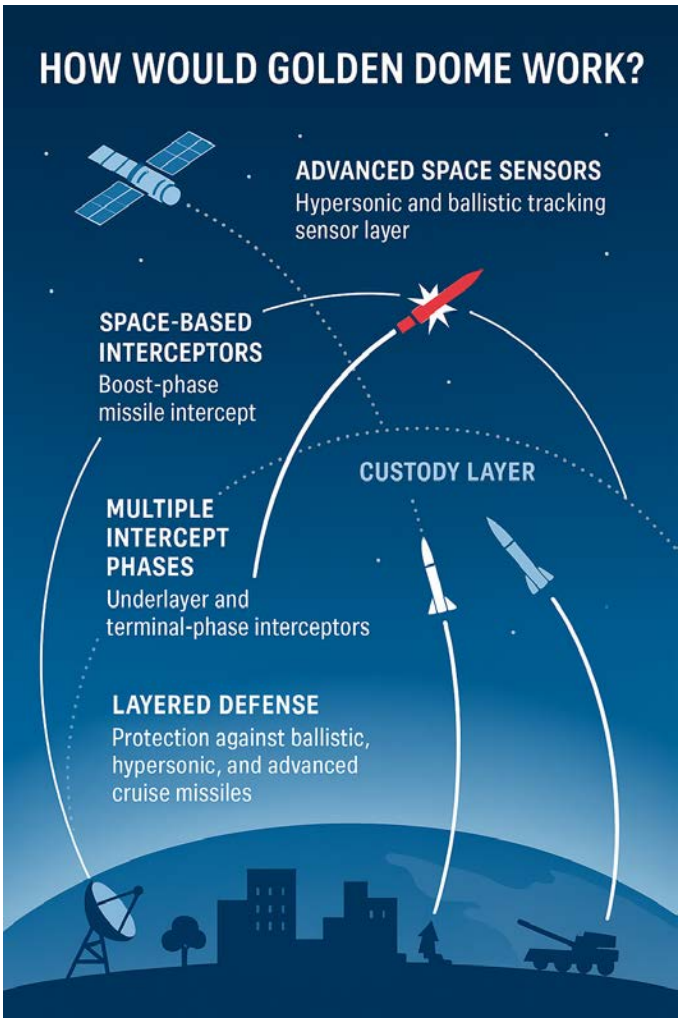
Key Takeaway

Golden Dome is the most expansive US missile defence plan ever proposed — a multi-layered shield stretching from Earth's surface into space, aimed at stopping everything from drones to advanced nuclear missiles.

While advocates promise greater protection, Golden Dome revives old dilemmas about cost, technical feasibility, weapons in space, and nuclear stability — and risks fueling a new arms race both on Earth and in orbit. For the United States, its allies, and the global community, Golden Dome risks pursuing security in ways that could undermine strategic stability, strain alliances, and weaken international norms.

What Is Golden Dome?

Executive Order 14186 "The Iron Dome for America," was issued by President Trump on January 27, 2025 and directs the US Department of Defense (DOD) to develop "a next generation missile shield" that vastly expands the US missile defence mission. That shield was later renamed "Golden Dome."



The order proposes a large-scale, layered air-and-missile defence system that is intended to provide nationwide or continental protection against all types of missiles, drones, and other aerial threats.

What Is the Purpose of the Missile Shield?

The Executive Order describes a vast system with the ability to intercept everything from ballistic and hypersonic missiles to attacks from outer space. Whereas previous US missile defences focused on regional threats from states like North Korea and Iran, Golden Dome targets advanced nuclear arsenals from rivals like Russia and China. This shift, initiated by the 2019 Missile Defense Review, raises the stakes for global stability.

How Would Golden Dome Work?

The Golden Dome concept lays out an ambitious multi-layered defence process that resembles a system-of-systems approach designed to counter a wide range of threats—including ballistic, hypersonic, and advanced cruise missiles—at different stages of flight.

Core elements include:

- **Advanced Space Sensors:** A new space-based tracking network to detect and follow high-speed threats like hypersonic missiles from launch onward.
- **Space-Based Interceptors:** Armed satellites positioned in orbit to destroy missiles in their early "boost phase" before they reach top speed.
- **Multiple Intercept Opportunities:** Backup interceptors stationed closer to Earth to engage missiles during midcourse and terminal phases if earlier attempts fail.

Supporting elements include:

- **Custody Layer:** A continuous tracking network that keeps missile threats under con-

stant observation—from detection to interception—ensuring accurate targeting data at every stage.

- **Non-Kinetic Measures:** Cyber and electronic warfare techniques used to disable or interfere with missile systems without physical interception.
- **Secure Supply Chain:** Measures to protect and ensure reliable sourcing of the critical technologies needed to build and operate the system.

What Is Included in the Space-Based Layer?

A key feature that sets Golden Dome apart from existing US missile defence is its dedicated space-based layer of *both* sensors in orbit to spot and track enemy missiles, *and* interceptors, presumably to defeat missiles in the so-called "boost-phase" of flight.

Sensors

Missile defence starts with seeing the threat. The United States relies heavily on satellites to spot missile launches, track the paths of those missiles, and guide interceptors to stop the missiles. These space-based sensors are already a critical part of existing missile defence systems and will become even more important as new threats like hypersonic missiles emerge.

What's already up there:

- **Defense Support Program (DSP):** Older satellites that still help to detect missile launches using infrared sensors.
- **Space-Based Infrared System (SBIRS):** The main system today for spotting missile launches around the world and tracking them in their early stages.
- **Next-Generation Overhead Persistent Infrared (OPIR):** A new system being built to replace SBIRS, with a better ability to detect faster, harder-to-track threats like hypersonic missiles.

What's next:

- **HBTSS (Hypersonic and Ballistic Tracking Space Sensor):** A new generation of satellites designed to follow hypersonic missiles — high-speed weapons that fly low and change direction mid-flight, making them harder to spot with regular radar.
- **Custody Layer (part of the Proliferated Warfighter Space Architecture):** A planned network to keep constant, precise watch over missiles during every part of their flight.

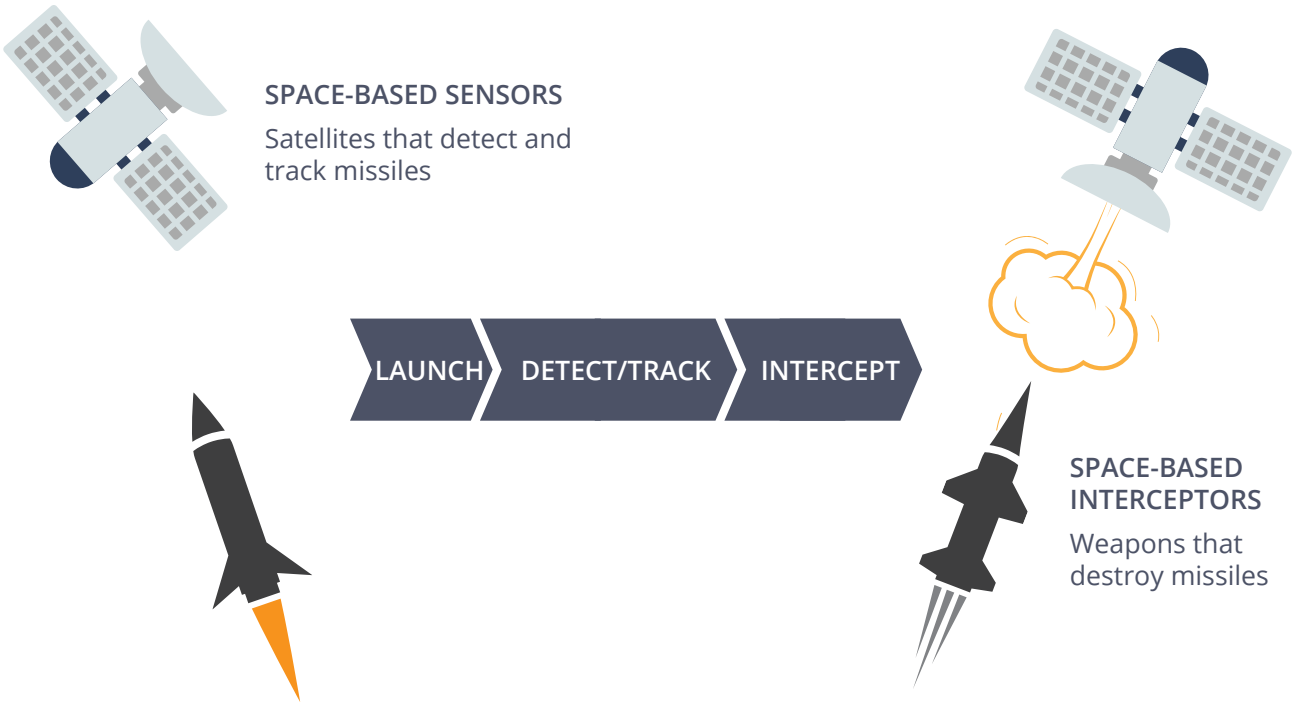
Golden Dome would build on and connect these systems into a bigger, more powerful sensor network in space, ostensibly capable of spotting advanced missile threats in real time.

These satellites don't carry weapons. Their job is to *see* and *track* — feeding data to interceptors based on Earth (or possibly in orbit in the future).

Interceptors

Golden Dome breaks new ground with its plan to deploy interceptors in space — an idea first seriously studied with Strategic Defense Initiative (SDI) in the 1980s (see below). In theory, these armed satellites would be capable of physically destroying enemy missiles in their boost-phase, before they could deploy multiple warheads or countermeasures.

However, no country has ever fielded operational space-based interceptors. The concept not only faces serious technical, financial, and strategic challenges; it also revives long-standing debates about the desirability and consequences of putting weapons in space.



SPACE-BASED SENSORS VS. INTERCEPTORS

Iron Dome is a battlefield-tested local shield; Golden Dome aims for a much larger protective umbrella, but faces huge technical, financial, and strategic hurdles.

Is Golden Dome like Israel's Iron Dome?

No. Golden Dome is far more ambitious than Iron Dome, a well-tested, short-range system that has been shielding cities and towns from rockets and artillery attacks since 2011.

Iron Dome v. Golden Dome

	IRON DOME	GOLDEN DOME
PURPOSE	Protects small areas (e.g., cities) from short-range rockets and artillery	Vision is for broad, layered defence for entire countries or regions from drones, missiles, and other threats
SCALE	Local/tactical coverage	National/continental coverage
STATUS	Operational since 2011; combat-proven	Conceptual; no operational system yet
TECHNOLOGY	Mobile batteries with radar and interceptors	Likely multi-layered: satellites, ground interceptors, space-based interceptors, advanced sensors; details still undefined
OWNERSHIP	Israel; partly funded by the United States	Proposed US-led program; details TBD

Is Golden Dome a New Concept?

Golden Dome is not the first space-focused anti-missile defence proposal pursued by the United States. It was preceded by earlier programs, most notably the Strategic Defense Initiative (SDI), which ultimately failed to meet objectives.

Proposed on March 23, 1983, by President Ronald Reagan, SDI — also known as "Star Wars" — was intended to provide a missile defence shield that could protect the United States from nuclear-armed ballistic missile attacks. Its aim was to render nuclear weapons obsolete by undermining the doctrine of mutually assured destruction.

Like Golden Dome, SDI lacked a clear and cohesive design. Scientists and defence experts explored a wide array of technologies, including space- and ground-based lasers, interceptor missiles, and complex tracking systems. Notable was Brilliant Pebbles — a program to deploy thousands of small, autonomous satellites that could detect and intercept enemy missiles in space. It faced huge cost and feasibility challenges and was ultimately cancelled in the early 1990s as the Cold War ended.

Brilliant Pebbles

Brilliant Pebbles was one of the most advanced and practical proposals considered under the Strategic Defense Initiative of the 1980s. The plan was to deploy thousands of small, autonomous satellites — each a "pebble" — that would orbit Earth, detect enemy missiles, and intercept them in space.

KEY FEATURES

Space-Based Interceptors

Tiny satellites with sensors and thrusters to track and collide with missiles.

Distributed System

Large numbers for redundancy, making the disabling of the entire network by an enemy more difficult.

Technical Promise, Political Hurdles

Although Brilliant Pebbles was more feasible than earlier laser concepts, costs, arms control concerns, and shifting political priorities led to its cancellation in the early 1990s.

Brilliant Pebbles stands as an early example of an attempt to develop capabilities that today's Golden Dome aims to revive, raising similar questions about deploying weapons and interceptors in space.

Source: Atomic Heritage Foundation

Doesn't the United States Already Have a Missile Defence System?

The United States has built a multi-layered missile defence system that employs interceptors on land and at sea. Despite decades of effort and the spending of hundreds of billions of dollars, US ability to stop modern missile threats remains limited.

What systems are in place?

- **Ground-Based Midcourse Defense (GMD):** Missiles based in Alaska and California, designed to shoot down long-range ballistic missiles (like those from North Korea) in space during their flight.
- **Aegis Ballistic Missile Defense:** Navy ships and some land-based sites equipped to intercept short- and medium-range missiles, mainly to protect US forces and allies overseas.
- **THAAD (Terminal High Altitude Area Defense):** Mobile launchers that shoot down missiles as they re-enter the atmosphere, near the end of their flight.
- **Patriot System:** Battlefield air defence focused on short-range threats like drones, aircraft, and tactical missiles.
- **Radars and Satellites:** Early warning systems that detect and track missile launches, although current coverage struggles with fast, low-flying weapons like hypersonic missiles.

The United States has spent an estimated $350 billion trying to build effective missile defences since the 1950s. Some progress has been made, especially against limited or regional threats. But these defences are far from foolproof, especially against new types of weapons, larger-scale attacks, or even simple decoys. Golden Dome has been proposed as a way to respond to emerging threats, including through the use of space-based interceptors; however, familiar questions about cost, feasibility, and destabilizing strategic consequences remain.

Is Golden Dome Even Possible?

Building a shield to protect the entire United States from *every* kind of airborne threat sounds appealing, but faces major technical roadblocks. Many of these challenges are not new; as noted above, past efforts like SDI and Brilliant Pebbles ran into the same problems.

Here's what makes Golden Dome so difficult:

1. Catching Missiles Right After Launch (Boost-Phase Interception)

The main idea behind space-based interceptors is to destroy missiles early, right after they launch, during what is called the boost phase. While in this phase, missiles are easier to spot. They are hot, bright, and flying more slowly than they will later in their flight. Plus,

they haven't yet released decoys or multiple warheads.

But there are reasons why this goal remains elusive:

- The boost phase only lasts from two to five minutes — a small amount of time to detect, track, launch an interceptor, and hit the target.
- Interceptors in space are orbiting Earth at thousands of kilometres per hour. Thousands of interceptors in space are required to make sure that *one is always in the right place at the right time*.
- A study by the American Physical Society estimated that defending against a single solid-fuel missile from North Korea could require up to 1,600 space-based interceptors—and as many as 36,000 if faster response times are needed.

Golden Dome, however, is aimed at stopping much larger and more sophisticated arsenals from nuclear peers like Russia and China, whose combined landmass and missile capacity far exceed that of North Korea. Scaling up to cover those threats would likely require tens of thousands of orbital interceptors.

Even with smarter satellites and better sensors, you can't bend the laws of physics. Satellites can't be everywhere at once, and missiles move rapidly. Gaps would still exist, and putting weapons in orbit on this scale would likely face strong public and international resistance.

2. Seeing and Tracking Every Threat

To defend against everything from drones to hypersonic missiles, you need to *see* threats the moment they appear and track them in real time.

The United States already uses a mix of technologies:

- Military radars on the ground and in space
- Regional and tactical radar systems
- Civilian air traffic radars.

But these weren't built to detect *all* threats, especially stealthy or low-flying weapons like cruise missiles or hypersonic gliders. The mountain of data that sensors produce must be combined and understood quickly, which remains a major challange with existing fragmented systems.

Some experts argue the United States should first focus on connecting the systems it already has, using artificial intelligence (AI) and big data tools to create a more complete picture of what's happening in the sky. Still, even advanced software can't solve everything. Hypersonic weapons, which fly quickly, at low altitudes, and unpredictably, remain extremely difficult to track.

Golden Dome plans to provide complete coverage with new radar and satellite sensors, but building and launching these at scale is a major technical and financial challenge.

3. Making Everything Work Together (Systems Integration)

Even if the United States could see every threat, *responding* in time is another challenge. Missile defence requires split-second decisions based on a flood of data.

To be effective, Golden Dome would need to:

- Combine sensor data from land, sea, and space
- Coordinate multiple types of interceptors flying at different speeds and altitudes
- Automate decisions about what to shoot, when, and how.

That's an enormous task. While progress is being made on command-and-control software, experts warn that we're not there yet.

In short: for now, building a full-scale, real-time, globe-spanning missile shield remains more science fiction than reality.

How Much Would Golden Dome Cost?

Golden Dome is not just ambitious; it's poised to become the most expensive missile defence project in US history.

An Official Price Tag of $175 Billion — For Now

When first announced, President Trump estimated the cost of Golden Dome at $175 billion, with a $25-billion "down payment" already included in the 2025 budget package.

But costs are likely to go up.

A Final Cost of Half a Trillion Dollars — Or More

What sets Golden Dome apart is its space-based layer. Satellites and interceptors in orbit will be designed to catch missiles early in flight. This is also what makes it so expensive.

The Congressional Budget Office estimates that building and operating this space-based system alone could cost between $160 billion and $542 billion over 20 years. Even senior US defence officials agree that the higher end of this range is more realistic.

Billions of Dollars Already Flowing Into Missile Defence

Golden Dome is just one piece of a much larger U.S. effort. Billions of dollars are already being spent on existing systems, including:

- Ground-Based Midcourse Defense (GMD)
- THAAD and Aegis Ashore
- Patriot batteries
- Surveillance radars and domain awareness tools.

New legislation, like the IRONDOME Act, is driving even more funding into upgrades and expansions, alongside billions of dollars for research into space-based capabilities.

Just Defending Guam Could Cost Eight Billion Dollars

For perspective: Lieutenant General Robert Rasch testified that building a missile defence system for Guam, a US territory with fewer than 200,000 people, would cost about $8 billion, using today's available technology.

Now imagine scaling that up:

- By land area, defending the entire United States could cost at least $119 billion.
- By number of cities, the estimate skyrockets to $6.4 trillion.

These rough figures show the immensity of the challenge.

The space layer is the most expensive and complex part of Golden Dome. While some analysts see it as a bold investment in national defence, others warn that it could become a costly gamble with a high risk of failure and few guarantees of success.

Strategic Stakes and Governance Challenges

Golden Dome is more than just a technological project. With far-reaching strategic, legal, and governance consequences, it revives unresolved debates about missile defence, arms control, and the weaponization of space.

Weapons Flashpoint

- **Legal Grey Zones:** The 1967 Outer Space Treaty bans nuclear and other weapons of mass destruction in orbit but does not explicitly prohibit conventional weapons. Golden Dome could take advantage of this loophole, but at a serious diplomatic cost.
- **Global Pushback:** For decades, most countries — including US rivals like Russia and China — have supported international efforts to prevent an arms race in space. The United Nations agenda item on the "Prevention of an Arms Race in Outer Space" (PAROS) reflects widespread concern about exactly the kind of development that Golden Dome represents.
- **Destabilizing potential:** Space-based interceptors could be repurposed to target sat-

ellites, raising fears of dual-use weapons and undermining trust. In a crisis, they could also become targets themselves — and their destruction could create dangerous space debris.

Nuclear Risks and the Arms Race Dilemma

Golden Dome raises a classic and still unresolved question in nuclear strategy: Does building a better shield make us safer — or does it provoke others to build more swords?

- **Undermining Deterrence:** For much of the Cold War, peace was based on mutual vulnerability — the idea that no side would launch nuclear weapons because everyone would suffer from catastrophic retaliation. This notion of peace was formalized in the 1972 Anti-Ballistic Missile (ABM) Treaty, which limited missile defences and banned them in space to preserve strategic stability.
- **Eroding Arms Control:** U.S. withdrawal from the ABM Treaty in 2002 raised concerns that missile defences would drive countries to build more nuclear weapons. Golden Dome could escalate this risk by targeting strategic forces from Russia and China, not just regional threats. China has already warned the system would upset nuclear stability and complicate future arms control talks.
- **Escalation Risks:** Rather than deterring conflict, such a shield could make adversaries more likely to act preemptively in a crisis, out of fear that their nuclear deterrent could be neutralized.

Allied Participation and the Canadian Question

Golden Dome is not designed to be a purely US shield. From the outset, it has been framed as a multinational effort, building on existing defence partnerships and collective infrastructure.

The initial US directive explicitly calls for bilateral and multilateral cooperation in research, development, and deployment, reflecting the scale, cost, and technical demands of covering a global threat environment.

Who Could Be Involved:

- Canada has already been asked to join, with reports of a potential $71 billion Canadian contribution. This speculation has reignited long-standing Canadian debates about missile defence, arms control, and space weaponization — issues that led Canada to reject participation in US missile defence in 2005.
- While Canada is investing nearly CDN$40 billion in radar and surveillance upgrades under the North American Aerospace Defense Command (NORAD), joining Golden Dome would signal a major policy shift and raise new questions about strategic stabil-

For all partners, the dilemma is similar: How do you balance the appeal of collective defence with the political, legal, and strategic risks of participating in a US-led shield that extends into space?

ity, diplomacy, and public spending.

- Other NATO partners already contribute to missile defence infrastructure through platforms like Aegis Ashore and shared sensor systems. Some may see Golden Dome as a chance to expand these roles; others may balk at the scale and politics of space-based interceptors.
- Indo-Pacific allies such as Japan and Australia — both active in regional missile defence — are potential partners in data-sharing and technical collaboration. However, their participation could also affect regional arms dynamics.
- Industry partners such as Lockheed Martin, Boeing, Raytheon, and Northrop Grumman are already promoting technologies that could feed into Golden Dome's layered system, especially radar, sensors, satellites, and interceptor upgrades.

For all partners, the dilemma is similar: How do you balance the appeal of collective defence with the political, legal, and strategic risks of participating in a US-led shield that extends into space?

Conclusion

Golden Dome is more than just a missile shield. It's an ambitious attempt to reshape how the United States and its allies defend against a new generation of threats, from hypersonic weapons to nuclear missiles. Its promise of stronger protection comes with high costs, significant technical hurdles, and far-reaching implications for global security and the fragile balancing of nuclear deterrence.

By expanding missile defences into orbit, Golden Dome revives long-standing debates

about the weaponization of space and the risks of an unconstrained arms race that could extend far beyond Earth. For decision-makers around the world, the core challenges will be to weigh whether the added layers of protection justify the financial, technical, and strategic costs; and to determine what the implementation of Golden Dome means for arms control and global stability in an increasingly contested security environment.

Project Ploughshares is a Canadian peace research institute with a focus on disarmament efforts and international security, specifically related to the arms trade, emerging military and security technologies, nuclear weapons, the protection of civilians, outer space, and the intersection of climate, peace, and security.

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